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Title : Whales, seals and krill of the Southern Ocean: Finding the balance

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Abstract : The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) has a mandate to manage Southern Ocean resources using an ecosystem approach. In accordance with this, an ecosystem model of the South Georgia and South Orkneys areas (FAO Subareas 48.3, 48.2) was constructed using the modeling software Ecopath with Ecosim. Our goal was to use the model to explore the complex interactions between marine mammals and one of their main prey, the Antarctic krill (Euphausia superba). In particular, we sought to test what effect an increased krill fishery might have on the Antarctic ecosystem (i.e., an increase from the current catch of about 100 000 tonnes of krill per year to the quota of 4 million tonnes/year that was set in 2000). Our model predicts that the expanded fishery will cause small declines in the biomass of several top predators if krill recruitment remains relatively consistent from year to year. Species that will likely decline include Antarctic fur seals, crabeater seals, and baleen whales, which may serve as potential indicator species for the monitoring of the impacts of the fishery on the system as a whole. This scenario, however, suggests an expanded krill fishery will not significantly affect community composition. Yet, this is not the case if krill abundance fluctuates annually. Acoustic surveys have suggested that krill biomass may fluctuate by up to an order of magnitude, with 2 to 3 years of low krill availability per decade. Under this scenario our model indicates that years of low krill abundance would have strong negative impacts on the reproductive biology of predators (as observed in field studies). The proposed krill fishery would further exacerbate these impacts. Our findings emphasize the need for a better understanding of the natural variability of krill abundance before expanding krill fishing in the Antarctic.